Ordering number: EN 3951B

Monolithic Linear IC

No. 3951B

LA7391AN

Global VHS-format VCR Video Signal Processor

Overview

The LA7391AN is a multi-format, single-chip video signal processing IC that supports TV systems around the world.

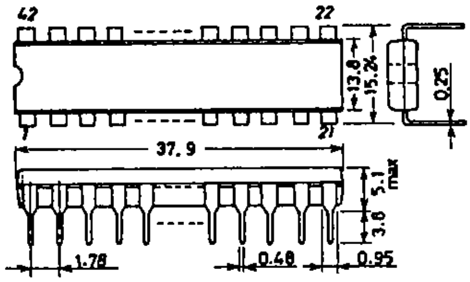
Features

- Compatible with TV systems around the world (NTSC/PAL/MESECAM/4.43 -NTSC/PAL-M/PAL-N).
- All filters on chip, except for PB-LPF for chroma (cutoff frequency requires no adjustment).
- No adjustment of YNR and DOC levels.
- Double high-pass noise canceller on chip.
- Linear phase-type picture control on chip.
- fsc output can be used as clock for OSD IC.
- DCC circuit on chip.
- Pilot burst erasure circuit on chip.
- High-speed AFC circuit on chip.
- Switching noise canceller on chip.
- Smallest package in the industry.
- Few components needed.
- 2fsc output.
- I/O pin for CNR insertion added.
- YNR/LNC switching possible.

Package Dimensions

unit: mm

3025B-DIP42S



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}max$		7.0	V
Allowable power dissipation	Pdmax	Ta ≦65°C	1020	mW
Operating temperature	Topr		–10 to +65	°C
Storage temperature	Tstg		–40 to +150	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5.0	V
Operating supply voltage range	$V_{CC}op$		4.8 to 5.5	V

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Operating Characteristics at Ta = 25°C, V_{CC} = 5.0 V

Parameter	Symbol	Input	Output	Conditions	min	typ	max	Unit
[REC Mode Y]								
Current drain REC	I_{CCR}			When V_{CC} = 5 V (when there is no signal), measure sum of incoming current at pins 35 and 28	95	120	145	mA
AGC adjustment	C_{AGC}	T37A		V_{IN} = 1.0 Vp-p video signal, use VR39 to adjust T4 output to 0.5 Vp-p				
VCA control characteristics	VCA	T37A	T4	Measure T4 output level when S10 is set to 2	0.48	0.5	0.52	Vp-p
AGC adjustment voltage	V_{AGC}	T37A	T39	Measure T39 DC voltage in above state	3.2	3.4	3.6	V
AGC detection voltage	V_{AD}	T37A	T38	Measure T38 DC voltage in same manner	1.2	1.4	1.6	V
EE output level	V_{EE}	T37A	T34A	Measure T34A output level in same manner	0.95	1.00	1.05	Vp-p
AGC Output 1	AGC 1	T37A	T4	V_{IN} = 2.0 Vp-p video signal Measure T4 output level	500	540	560	mVp-p
AGC Output 2	AGC 2	T37A	T4	V_{IN} = 0.5 Vp-p video signal Measure T4 output level	470	490	500	mVp-p
AGC Output 3	AGC 3	T37A	T4	V_{IN} = 700 mVp-p LUMI, 600 mVp-p SYNC Measure T4 SYNC level	135	150	165	mVp-p
AGC Output 4	AGC 4	T37A	T4	V_{IN} = 700 mVp-p LUMI, 150 mVp-p SYNC Measure T4 SYNC level	70	85	100	mVp-p
Sync separation output level	V_{SYR}	T37A	T32	V_{IN} = 1.0 Vp-p video signal, Measure T32 output pulse wave high value	4.0	4.2	4.4	Vp-p
Sync separation output pulse width	PW_{SYR}	T37A	T32	V_{IN} = 1.0 Vp-p video signal, Measure T32 output pulse width	4.4	4.7	5.0	µs
Sync separation output leading edge delay time	ΔT_{SYR}	T37A	T32	V_{IN} = 1.0 Vp-p video signal, measure delay time of output SYNC versus input SYNC	0.6	0.8	1.0	µs
Sync separation threshold level	TH_{SYR}	T37A	T32	Gradually attenuate the input level, measure input level at point when output pulse width widens 1 µs or more beyond PWSYR		–18	–14	dB
Sync tip level, pedestal level, white level measurement (REC)	L_{VOR}	T37A	T34	Measure electric potential for each of the T34 video output sync tip, pedestal, and white peak, and assign the measured values to L_{SYN}, L_{PED}, and L_{WHI}, respectively				
Pseudo V insertion level (REC)	Δ VDR	T37A	T34	Measure T34 DC voltage when 5 V is applied to T33, and assign the measured value to L_{VDR} and calculate the difference with L_{SYN} $\Delta VDR = L_{SYN} - L_{VDR}$	–80	0	80	mV
Pseudo H insertion level (REC)	Δ HDR	T37A	T34	Measure T34 DC voltage when 2.7 V is applied to T33, and assign the measured value to L_{HDR} and calculate the difference with L_{PED} $\Delta HDR = L_{PED} - L_{HDR}$	–200	–100	0	mV
White insertion level (REC)	Δ WHR	T37A	T34	Measure T34 DC voltage when 1.3 V is applied to T33, and assign the measured value to L_{WHR} and calculate the difference with L_{WHI} $\Delta WHR = L_{WHI} - L_{WHR}$	150	250	350	mV
VCA detection voltage	V_{VCA}	T37A	T9	Measure T9 DC voltage	3.1	3.4	3.7	V
REC YNR operation EP/LP	VR-YNR	T37A	T3	V_{IN} = white 50% + CW (15.8 mVp-p) ratio between $32f_H$ component and $32.5f_H$ component	3.5	4.5	5.5	dB
Y-LPF frequency characteristics	YLPF 1	T37A	T3	V_{IN} = standard multiburst signal 1 Vp-p, 2 MHz response to 500 kHz at T3	0.2	0.7	1.2	dB
	YLPF2	T37A	T3	V_{IN} = standard multiburst signal 1 Vp-p, 4.8 MHz response to 500 kHz at T3	–4.5	–3.5	–2.5	dB
	YLPF3	T37A	T3	V_{IN} = standard multiburst signal 1 Vp-p, 2 MHz response to 500 kHz at T3, T22A: 5 V	0.4	0.9	1.4	dB
	YLPF4	T37A	T3	V_{IN} = standard multiburst signal 1 Vp-p, 4.8 MHz response to 500 kHz at T3, T22A: 5 V	–5.0	–4.0	–3.0	dB
FM modulator output level	V_{FM}		T40	No input, use VR42 to adjust output frequency to 4 MHz, measure output level	0.8	1.0	1.2	Vp-p
FM modulator secondary distortion	H_{MOD}		T40	Ratio of 8 MHz component to 4 MHz in the above state		–40	–35	dB

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Parameter	Symbol	Input	Output	Conditions	min	typ	max	Unit
FM modulator modulation sensitivity	S_{MOD}	T4	T40	Measure amplitude of change in output frequency when 2.6 V DC or 3.1 V DC is applied to T4, 2 x (f3.1 – f2.6)	1.6	2.0	2.4	MHz/V
FM modulator linearity	L_{MOD}	T4	T40	Measure output frequency when 2.85 V DC applied to T4, $L_{MOD} = \frac{f2.85 - (f3.1 + f2.6)/2}{S_{MOD}} \times 100$	–2	0	+2	%
1/2 f_H carrier shift	CS1		T40	Measure amplitude of change in output frequency when SW41B is off and SW41A is switched from on to off	6.8	7.8	9.5	kHz
	CS2		T40	Measure amplitude of change in output frequency when SW41B is on and SW41A is switched from on to off	6.8	7.8	9.5	kHz
Emphasis gain	G_{EMPH}	T4A	T5	V_{IN} = 0.5 Vp-p 10 kHz sine wave Measure ratio of levels of input and output amplitude at T5	–0.5	0	+0.5	dB
Detail enhancer characteristics	G_{ENH1}	T4A	T5	V_{IN} = 158 mVp-p 2 MHz sine wave Measure ratio of levels of T5 and T4, difference with G_{EMPH}	0.9	1.4	1.9	dB
	G_{ENH2}	T4A	T5	V_{IN} = 50 mVp-p 2 MHz sine wave Measure ratio of levels of T5 and T4, difference with G_{EMPH}	2.2	3.2	4.2	dB
	G_{ENH3}	T4A	T5	V_{IN} = 15.8 mVp-p 2 MHz sine wave Measure ratio of levels of T5 and T4, difference with G_{EMPH}	4.0	5.0	6.0	dB
	G_{ENH4}	T4A	T5	V_{IN} = 15.8 mVp-p 2 MHz sine wave Measure output amplitude at T5 in edit mode, difference with G_{EMPH}	1.8	2.8	3.8	dB
Nonlinear emphasis characteristics	G_{NLEMP1}	T4A	T5	V_{IN} = 500 mVp-p 2 MHz Measure ratio of levels of T5 and T4, difference with G_{EMPH}	0.5	1.4	2.3	dB
	G_{NLEMP2}	T4A	T5	V_{IN} = 158 mVp-p 2 MHz Measure ratio of levels of T5 and T4, difference with G_{EMPH}	2.6	3.8	5.2	dB
	G_{NLEMP3}	T4A	T5	V_{IN} = 50 mVp-p 2 MHz Measure ratio of levels of T5 and T4, difference with G_{EMPH}	4.9	6.4	7.9	dB
Main linear emphasis characteristics	G_{ME1}	T4A	T5	V_{IN} = 50 mVp-p 200 kHz sine wave Measure ratio of levels of T5 and T4, difference with G_{EMPH}	4.9	5.2	5.5	dB
	G_{ME2}	T4A	T5	V_{IN} = 50 mVp-p 2 MHz Measure ratio of levels of T5 and T4, difference with G_{EMPH}	13.1	13.6	14.1	dB
White clipping level	L_{WC}	T4A	T5	V_{IN} = 500 mVp-p white 100% video signal Measure white clipping level at T5	186	193	200	%
Dark clipping level	L_{DC}	T4A	T5	V_{IN} = 500 mVp-p white 100% video signal Measure dark clipping level at T5	–60	–55	–50	%
[PB Mode Y]								
Current drain PB	$I_{CC}P$			Incoming current at pins 35 and 28 when V_{CC} = 5.0 V	125	155	185	mA
Dropout compensation period	T_{DOC}	T39A T4A	T34A	T39A: 4 MHz, 300 mVp-p sine wave T4A: 0.5Vp-p video signal T34A: time from when input went to 0 until T34A output returned, SW10 → 1	0.35	0.5	0.65	ms
DOC loop gain	GDOC	T39A T4A	T12	T39A: 4 MHz, 300 mVp-p sine wave T4A: 0.5Vp-p video signal T39A: Input/output response when 5H have elapsed after input went to 0, SW10 → 3	–1.0	0	+1.0	dB
FM demodulation voltage	V_{DEM4}	T39A	T3	V_{IN}=300 mVp-p, f = 4 MHz, Output DC voltage	1.5	2.0	2.5	V
FM demodulation sensitivity	S_{DEM}	T39A	T3	V_{IN} = 300 mVp-p, f = 2 MHz, V_{DEM2} V_{IN} = 300 mVp-p, f = 6 MHz, V_{DEM6} Calculate $S_{DEM} = (V_{DEM6} - V_{DEM2})/4$	0.36	0.45	0.54	V/MHz

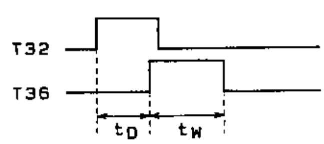
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Parameter	Symbol	Input	Output	Conditions	min	typ	max	Unit
FM demodulation linearity	L_{DEM}	$L_{DEM} = \frac{V_{DEM4} - (V_{DEM6} + V_{DEM2})/2}{V_{DEM6} - V_{DEM2}} \times 100$			–3.5	0	+3.5	%
Carrier leak	CL	T39A	T3	V_{IN} = 300 mVp-p, f = 4 MHz Ratio between 4 MHz component of T3 and S_{DEM}		–40	–35	dB
PB YNR characteristics LP/EP	GP-YNR	T4A	T28A	V_{IN} = white 50% + CW (15.8 mVp-p) Ratio between $32f_H$ component and $32.5f_H$ component	–11	–9	–7	dB
PB LNC characteristics SP	GP-LNC	T4A	T28A	V_{IN} = white 50% + CW (15.8 mVp-p) Ratio between $32f_H$ component and $32.5f_H$ component	–7.0	–5.5	–4.0	dB
Playback through gain	G_{PB}	T4A	T34A	Apply V_{IN} = 0.5 Vp-p video signal to pin 4, and determine ratio between T34A output level and input level	4.0	5.5	7.0	dB
Nonlinear de-emphasis characteristics	GNL_{DEEM1}	T4A	T34A	V_{IN} = white 50% + CW (f = 1 MHz, 158 mVp-p) measure input/output response, difference with GPB	–2.8	–1.8	–0.8	dB
	GNL_{DEEM2}	T4A	T34A	f = 1 MHz, 50 mVp-p	–5.0	–4.0	–3.0	dB
Noise canceller characteristics	G_{WNC1}	T4A	T34A	f = 1.5 MHz, 158 mVp-p	–1.3	–0.8	–0.3	dB
	G_{WNC2}	T4A	T34A	f = 1.5 MHz, 50 mVp-p	–4.5	–3.5	–2.5	dB
	G_{WNC3}	T4A	T34A	f = 1.5 MHz, 15.8 mVp-p	–10.5	–9.0	–7.5	dB
PIC-CTL center response characteristics	G_{PC}	T4A	T34A	f = 2 MHz, 158 mVp-p	1.2	1.7	2.2	dB
PIC-CTL hard response characteristics	G_{PH}	T4A	T34A	f = 2 MHz, 158 mVp-p	7.0	8.0	10.0	dB
PIC-CTL soft response characteristics	G_{PS}	T4A	T34A	f = 2 MHz, 158 mVp-p	–10.0	–8.0	–7.0	dB
Sync tip level, pedestal level, white level measurement (PB)	L_{VOR}	T4A	T34	With V_{IN} = white 100% and T34A at 1.0 Vp-p, measure electric potential for each of the pin 34 video output sync tip, pedestal, and white peak, and assign the measured values to L_{SYN}, L_{PED}, and L_{WHI}, respectively				
Pseudo V insertion level (PB)	Δ VDP	T4A	T34	Measure pin 34 DC voltage when 5 V is applied to pin 33, and assign the measured value to L_{VDP}, and calculate the difference with L_{SYN} Δ VDP = $L_{SYN} - L_{VDP}$	–80	0	80	mV
Pseudo H insertion level (PB)	Δ HDP	T4A	T34	Measure pin 34 DC voltage when 2.7 V is applied to pin 33, and assign the measured value to L_{HDP}, and calculate the difference with L_{PED} ΔHDP = $L_{PED} - L_{HDP}$	–300	–200	–100	mV
White insertion level (PB)	ΔWHP	T4A	T34	Measure pin 34 DC voltage when 1.3 V is applied to pin 33, and assign the measured value to L_{WHP}, and calculate the difference with L_{WHI} ΔWHP = $L_{WHI} - L_{WHP}$	20	120	220	mV
Sync separation output level	V_{SYP}	T4A	T32	V_{IN} = 0.5 Vp-p video signal, pin 32 output pulse wave high value	4.0	4.2	4.4	Vp-p
Sync separation output pulse width	PW_{SYP}	T4A	T32	V_{IN} = 0.5 Vp-p video signal, T32 output pulse width	4.4	4.7	5.0	µs
Sync separation output leading edge delay time	Δ T_{SYP}	T4A	T32	V_{IN} = 0.5 Vp-p video signal, measure delay time of output SYNC versus input SYNC	0.9	1.1	1.3	µs
4.2 V regulator operation check	V_{REG}		T30	Measure DC level of T30 in REC mode	3.95	4.15	4.35	VDC
[REC Mode Chroma]								
REC chroma low-band conversion output level	V_{OR-15}	T37A	T15A	V_{IN} = standard color bar signal (1 Vp-p), measure burst level at T15A	120	160	200	mVp-p
Burst emphasis amount (NTSC mode)	GBE	T37A	T15A	V_{IN} = standard color bar signal (1 Vp-p) Ratio of burst level at T15A when S41A is off (SP/EP) and on (LP)	5.5	6.0	6.5	dB

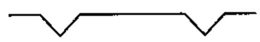
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Parameter	Symbol	Input	Output	Conditions	min	typ	max	Unit
VXO oscillation level	$V_{VXO\text{-}R}$	T37A	T19	V_{IN} = standard color bar signal (1 Vp-p), measure T19 output amplitude (with a FET probe)	450	560	670	mVp-p
REC ACC characteristics	ACC_{R1}	T37A	T15A	V_{IN} = standard color bar signal (1 Vp-p), input +6 dB chroma signal level only, measure T15A burst level, and calculate ratio with V_{OR}-15		0.2	0.5	dB
	ACC_{R2}	T37A	T15A	V_{IN} = standard color bar signal (1 Vp-p), input –6 dB chroma signal level only, measure T15A burst level, and calculate ratio with V_{OR}-15	–0.5	–0.1		dB
REC ACC killer input level	$VACC_{K\text{-}ON}$	T37A	T15A	V_{IN} = standard color bar signal (1 Vp-p), lower the chroma signal, and measure the input burst level at the point where output at T15A ceases, and calculate the ratio with the standard input level		–26		dB
REC ACC killer output level	VO_{ACCK}	T37A	T15A	Use a spectrum analyzer to measure the output level at T15A in the killer state described previously; ratio with $V_{OR\text{-}15}$		–60	–50	dB
Input level for REC ACC killer return	$V_{ACCK\text{-}OFF}$	T4A	T34A	Starting from the killer state described previously, gradually raise the input chroma level and measure the input burst level when output is generated at T15A and calculate the ratio with the standard input level		–20		dB
VXO control sensitivity	S_{VXO}	T37A	T17 T19A	Measure the pin 17 DC voltage when a standard color bar signal is input (1 Vp-p)...V_0 Measure the frequency at T19A when V_0 is applied to pin 17 from the external power supply...f_1 Measure the frequency at T19A when V_0 + 10 mV is applied to pin 17...f_2 $S_{VXO} = \frac{f_2 - f_1}{10}$ Hz/mV	3.8	5.7	7.6	Hz/mV
REC APC pull-in range	Δf_{APC1}	T37A	T15A	Input a 50% white signal overlapped with a 4.4336 MHz, 300 mVp-p continuous wave. After confirming that there is output at T15A, increase the frequency of the CW until the output at T15A stops, and then gradually reduce the frequency until output appears again at T15A; that CW frequency is f1. Δf_{APC1} = f1 – 4433619 (Hz)	350	440		Hz
	Δf_{APC2}	T37A	T15A	In the same manner, reduce the frequency of the CW until the output at T15A stops, and then gradually increase the frequency until output appears again at T15A; that CW frequency is f2. Δf_{APC2} = f2 – 4433619 (Hz)		–900	–350	Hz
BGP delay time	t_D	T37A	T32 T36	Measure waveforms at T32 and T36 when a standard color bar signal (1 Vp-p) is input. 		4.3		μs
BGP pulse width	t_W	T37A	T32 T36			4.8		μs

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Parameter	Symbol	Input	Output	Conditions	min	typ	max	Unit
REC AFC pull-in range	Δf_{AFC1}	T37A	T24	Input a string of pulses (negative polarity) at 300 mV, 15.6 kHz with a width of 5 μs. After increasing the frequency of the pulse string until the waveform at pin 24 is disrupted, then reduce the frequency until the waveform at pin 24 is normal again; that pulse string frequency is f_1. T24  $\Delta f_{AFC1} = f_1 - 15.625$ (kHz)	1.0	7.0		kHz
	Δf_{AFC2}	T37A	T24	In the same manner, after reducing the frequency of the pulse string until the waveform at pin 24 is disrupted, then increase the frequency until the waveform at pin 24 is normal again; that pulse string frequency is f_2. $\Delta f_{AFC2} = f_2 - 15.625$ (kHz)		−3.7	−1.0	kHz
[PB Mode Chroma]								
PB chroma video output level	Vop-34	T39A T15A T4A	T34A	In PB, SP mode, input a 4 MHz: 300 mVp-p continuous wave at T39A, and from T15A input a chroma signal (SP mode, burst 50 mVp-p) that underwent low-band conversion from a chroma noise test signal. Input a 50% white signal from T4A and measure the T34A burst level	240	300	360	mVp-p
PB chroma pin 31 output level	Vop-31	T39A T15A T4A	T31	Measure the T31 burst level under the same conditions as for Vop-34.	220	270	320	mVp-p
PB ACC characteristics	ACC_{P1}	T39A T15A T4A	T31	Input the input chroma level at +6 dB under the same conditions as for Vop-34 and measure the T31 burst level, and calculate the ratio with Vop-31.		0.5	0.8	dB
	ACC_{P2}	T39A T15A T4A	T31	Input the input chroma level at −6 dB under the same conditions as for Vop-34 and measure the T31 burst level, and calculate the ratio with Vop-31.	−0.5	−0.2		dB
PB killer input level	$V_{ACK\text{-}P}$	T39A T15A T4A	T31	Lower the input chroma level under the same conditions as for Vop-34 and measure the input burst level at the point where T31 chroma output ceases. (Calculate ratio with standard input of 50 mVp-p)	−40	−32	−25	dB
PB killer chroma output level	$V_{OACK\text{-}P}$	T39A T15A T4A	T34A	Use a spectrum analyzer to measure the T34 chroma output level in the killer state described previously. Calculate ratio with $V_{OP\text{-}34}$.		−44	−40	dB
PB main converter carrier leak	C_{LP}	T39A T14A T4A	T34A	Monitor T34A with a spectrum analyzer under the same conditions as for Vop-34 and calculate the ratio between the 4.43 MHz component and the 5.06 MHz carrier leak component.		−40	−33	dB
Burst de-emphasis amount (NTSC mode)	GBD	T39A T4A T27A	T31	From T39A, input a 4 MHz 300 mVp-p continuous wave; from T4A, input a 50% white signal, and calculate the ratio between the output level during the T31 burst interval and the output level during other intervals.	−4.40	−4.65	−4.90	dB
PB XO output level	$V_{XO\text{-}P}$		T19	Measure the PB mode T19 output level with an FET probe	480	610	750	mVp-p
PB XO oscillation frequency variation	Δf_{XO}		T19A	Measure the frequency at T19A during PB mode...f $\Delta f_{XO} = f - 4433619$ (Hz)	−9	0	+9	Hz

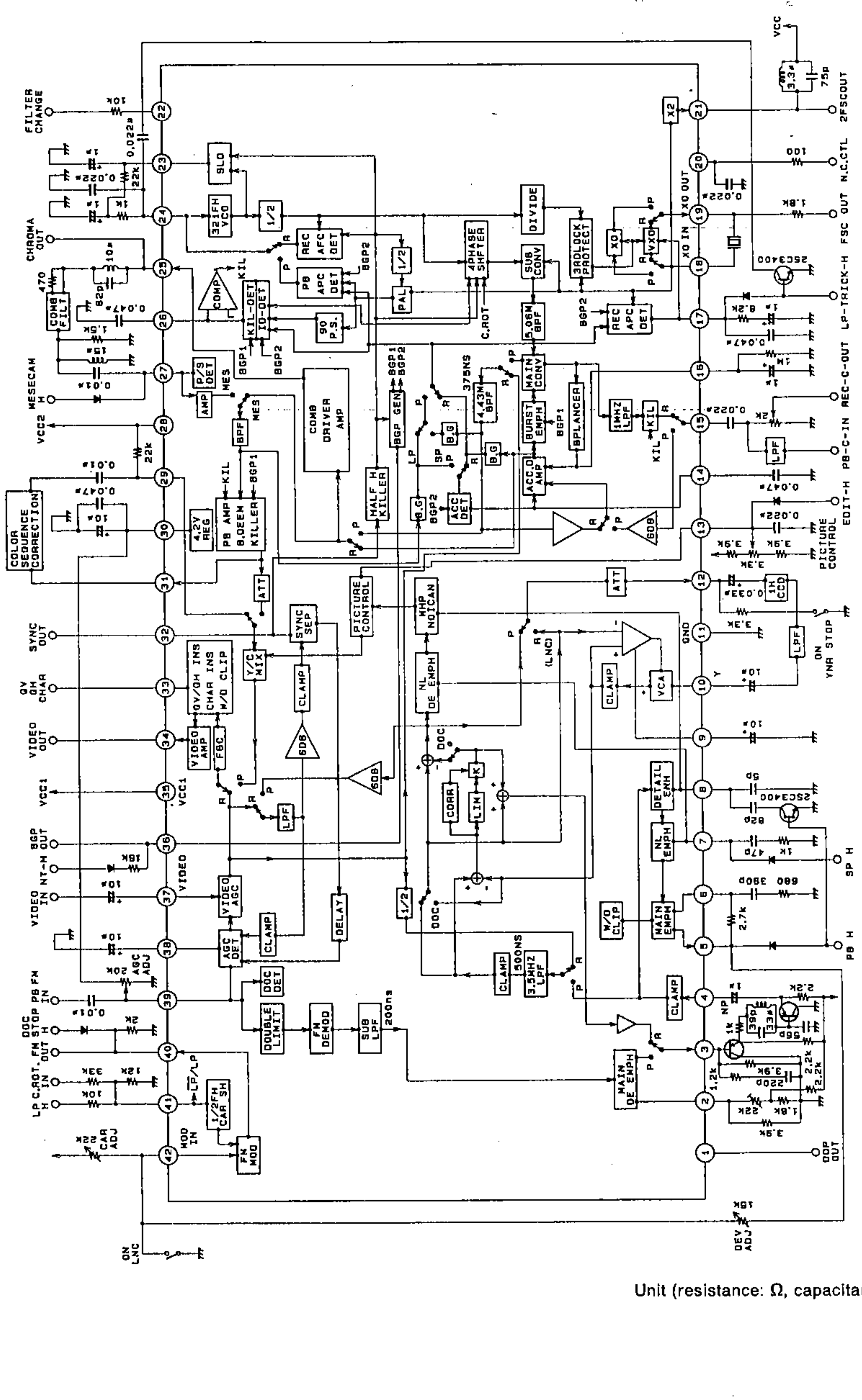
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Parameter	Symbol	Input	Output	Conditions	min	typ	max	Unit
SLD detection current	I_{SLD1}	T39A T4A	T23A	In PB mode, with S24: 3 and S23: off, input a 4 MHz 300 mVp-p continuous wave from T39A, input a 50% white signal from T4A, and measure the wave peak at T23A  I_{SLD1} = VOS1/1 kΩ		135		μA
	I_{SLD2}	T39A T4A	T23A	Same as above (however, S24 = 1)  I_{SLD2} = VOS2/1 kΩ		135		μA
2fsc output level	V2fsc		T21	In PB mode, measure the T21 output level with an FET probe	480	640	800	mVp-p

Note) A trap (4.84 MHz for NTSC systems and 5.69 MHz for PAL systems) is required in the chroma playback system (between pins 25 and 27 or between pins 31 and 29) in order to suppress unnecessary components in converter output.

Equivalent Circuit Block Diagram and Sample Application Circuit

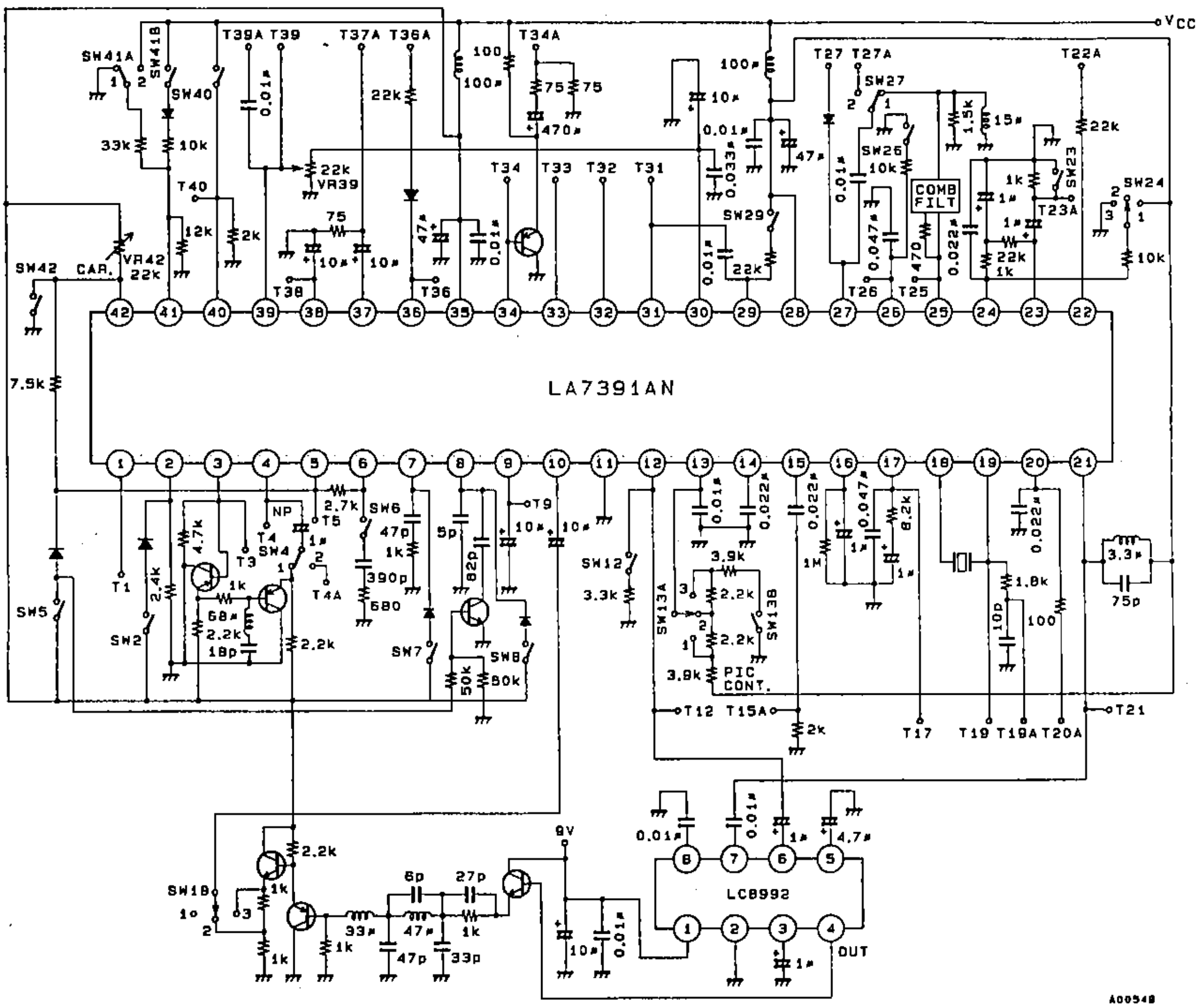


Unit (resistance: Ω, capacitance: F)

LA7391AN Control Pins

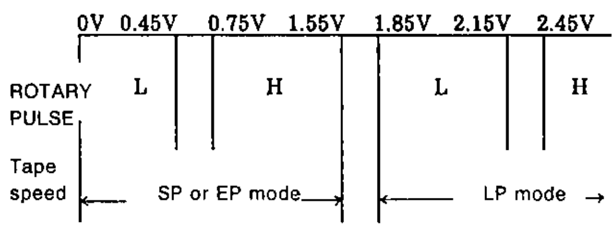
Pin No.	Function	Control	Contents
20	N.C control	Linear	When → high, N.C → Strong
22	Filter switching	H	3.58 MHz system
		L or OPEN	4.43 MHz system
42	YNR/LNC selection	OPEN	YNR
		L	LNC (line noise canceller)

Test Circuit Diagram

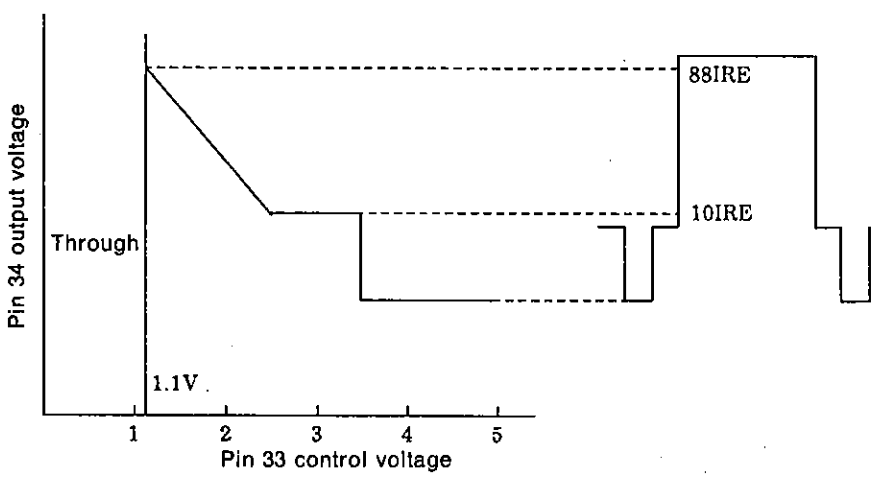


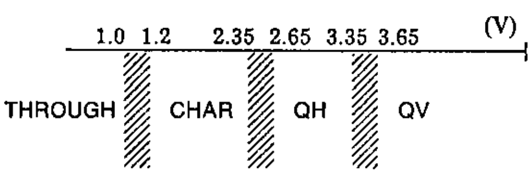
Unit (resistance: Ω, capacitance: F)

Control Pin Function Chart

Pin No.	L	M	H
Pin 5 R/P switching	Open REC mode		Over 3.8V PB mode
Pin 7 SP/EP switching	Open EP mode		Over 3.9 V SP mode
Pin13 EDIT2 PIC-CTL	2 V to 2.5 V PIC-CTL SOFT	2.5 V to 3 V PIC-CTL HARD	Over 3.6 V EDIT ON
Pin 14 SECAM CTL			Over 4.0 V SECAM mode
Pin 17 Special playback switching		Open Before comb in SP	Over 3.5 V (over 200 μA) After comb in SP
Pin 27 MESECAM CTL		Open	Over 3.0 V MESECAM mode
Pin 33 QV, QH, CHAR		Refer to Pin 33, QV, QH, CHAR, insertion diagram	
Pin 36 NTSC-CTL			NTSC mode if current is 150 μA or more
Pin 40 DOC STOP control	Open Normal mode		Over 3.9 V DOC STOP
Pin 41 ROTARY pulse LP switch			
Pin 42 YNR/LNC switch	Line NC when under 1 V in PB	Open SP: LNC, LP/EP: YNR	

Pin 33
QV, QH, CHAR, insertion





This catalog provides information as of May, 1995. Specifications and information herein are subject to change without notice.